

What is claimed is:

1 1. A method of detecting a moving object,
2 comprising:

3 (a) a first dividing step of dividing an input image
4 into a plurality of first unit blocks;

5 (b) a second dividing step of dividing a given
6 background image into a plurality of second unit blocks;

7 (c) a moving block extracting step of comparing said
8 first unit blocks with said second unit blocks for every
9 unit block and extracting a number of said first unit
10 blocks, which are different in brightness distribution
11 pattern from the corresponding second unit blocks, as
12 moving blocks;

13 (d) a moving area setting step of setting a moving
14 area that surrounds said moving blocks extracted in said
15 moving block extracting step; and

16 (e) a brightness comparing step of comparing a
17 distribution of brightness values of the input image with
18 a distribution of brightness values of the background
19 image in the moving area, which is set by said moving area
20 setting step, to discriminate whether or not a moving
21 object appears in the input image.

1 2. A moving object detecting method according to
2 claim 1, wherein said brightness comparing step includes:

3 an appearance frequency measuring step of measuring

4 a frequency of occurrence of pixels having a predetermined
5 brightness value; and

6 a trimming step of trimming the pixels, whose
7 appearance frequency is lower than the predetermined
8 value, from the pixels of the input image in the whole
9 range of various brightness values.

1 3. A moving object detecting method according to
2 claim 1, wherein in each of said first dividing step and
3 said second dividing step, the individual first unit block
4 overlaps neighboring unit blocks disposed adjacent to the
5 last-named first unit block.

1 4. A moving object detecting method according to
2 claim 1, wherein in said moving area setting step, said
3 moving area surrounding the moving blocks is rectangular
4 in shape.

1 5. A method of detecting a moving object,
2 comprising:

3 (a) a monitoring region clipping step of clipping
4 a monitoring region, which is to be monitored, from an
5 input image;

6 (b) a region dividing step of dividing the
7 monitoring region, which is clipped in said monitoring
8 region clipping step, into a plurality of zones;

9 (c) a variance calculating step of calculating a

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10 variance of brightness values for each and every one of
11 the plural zones obtained in said region dividing step;
12 and

13 (d) an appearance detecting step of discriminating
14 whether or not a moving object appears in the input image
15 based on the variance calculated in said variance
16 calculating step.

1 6. A moving object detecting method according to
2 claim 5, wherein said appearance detecting step includes:
3 a history information creating step of creating
4 history information about the variance calculated for
5 every one of the plural zones obtained in said region
6 dividing step; and

7 a variance comparing step of comparing the past
8 variance before a current time based on the history
9 information created in said history information creating
10 step with the current variance in the current time based
11 on the input image to discriminate whether an moving
12 object appears in the input image.

1 7. A moving object detecting method according to
2 claim 5, wherein in said appearance detecting step,

3 if the number of the zones whose variance is equal
4 to or higher than a first threshold is equal to or larger
5 than a predetermined value, the appearance of the moving
6 object is notified, and

7 if the number of the zones whose variance is equal
8 to or lower than a second threshold is equal to or larger
9 than a predetermined value, the absence of the moving
10 object is notified.

1 8. A moving object detecting method according to
2 claim 6, wherein in said appearance detecting step,

3 if the number of the zones whose variance is equal
4 to or higher than a first threshold is equal to or larger
5 than a predetermined value, the appearance of the moving
6 object is notified, and

7 if the number of the zones whose variance is equal
8 to or lower than a second threshold is equal to or larger
9 than a predetermined value, the absence of the moving
10 object is notified.

1 9. A moving object detecting method according to
2 claim 5, wherein in said appearance detecting step,

3 if the number of the zones whose increase value of
4 variance is equal to or higher than a third threshold is
5 equal to or larger than a predetermined value, the
6 appearance of the moving object is notified, and

7 if the number of the zones whose decrease value of
8 variance is equal to or higher than a fourth threshold
9 is equal to or larger than a predetermined value, the
10 absence of the moving object is notified.

1 10. A moving object detecting method according to
2 claim 6, wherein in said appearance detecting step,

3 if the number of the zones whose increase value of
4 variance is equal to or higher than a third threshold is
5 equal to or larger than a predetermined value, the
6 appearance of the moving object is notified, and

7 if the number of the zones whose decrease value of
8 variance is equal to or higher than a fourth threshold
9 is equal to or larger than a predetermined value, the
10 absence of the moving object is notified.

1 11. A moving object detecting method according to
2 claim 9, wherein in said appearance detecting step, a
3 reference value, based on which the increase value of
4 variance and the decrease value of variance are to be
5 calculated, is created from average values of the past
6 variances before the current time.

1 12. A moving object detecting method according to
2 claim 10, wherein in said appearance detecting step, a
3 reference value, based on which the increase value of
4 variance and the decrease value of variance are to be
5 calculated, is created from average values of the past
6 variances before the current time.

1 13. A moving object detecting method according to
2 claim 5, wherein in said appearance detecting step,

3 if the variance from which entering of the moving
4 object is to be detected is equal to or higher than a first
5 threshold, the appearance of the moving object is notified,
6 and

7 if the decrease value of variance from which leaving
8 of the moving object is to be detected is equal to or larger
9 than a fourth threshold, the absence of the moving object
10 is notified.

1 14. A moving object detecting method according to
2 claim 6, wherein in said appearance detecting step,

3 if the variance from which entering of the moving
4 object is to be detected is equal to or higher than a first
5 threshold, the appearance of the moving object is notified,
6 and

7 if the decrease value of variance from which leaving
8 of the moving object is to be detected is equal to or larger
9 than a fourth threshold, the absence of the moving object
10 is notified.

1 15. A moving object detecting method according to
2 claim 5, wherein in said appearance detecting step,

3 if an increase value of variance from which entering
4 of the moving object is to be detected is equal to or higher
5 than a third threshold, the appearance of the moving
6 object is notified, and

7 if the variance from which leaving of the moving

8 object is to be detected is equal to or lower than a second
9 threshold, the absence of the moving object is notified.

1 16. A moving object detecting method according to
2 claim 6, wherein in said appearance detecting step,

3 if an increase value of variance from which entering
4 of the moving object is to be detected is equal to or higher
5 than a third threshold, the appearance of the moving
6 object is notified, and

7 if the variance from which leaving of the moving
8 object is to be detected is equal to or lower than a second
9 threshold, the absence of the moving object is notified.

1 17. A moving object detecting method according to
2 claim 5, wherein in said appearance detecting step, the
3 monitoring region is set by expanding an assumed area of
4 the moving object.

1 18. A moving object detecting method according to
2 claim 6, wherein in said appearance detecting step, the
3 monitoring region is set by expanding an assumed area of
4 the moving object.

1 19. A method of detecting a moving object in an
2 input image, comprising:

3 (a) a monitoring region clipping step of clipping
4 a monitoring region, which is to be monitored, from the

5 input image;

6 (b) a first region dividing step of dividing the
7 monitoring region, which is clipped in said monitoring
8 region clipping step, into a plurality of zones in a
9 direction perpendicular to a direction in which the moving
10 object enters;

11 (c) a variance calculating step of calculating a
12 variance of brightness values for each and every one of
13 the plural zones obtained in said first region dividing
14 step;

15 (d) a zone discriminating step of discriminating
16 whether an individual one of the plural zones is an
17 object-appearing zone in which the moving object appears
18 or an object-free zone in which the moving object is absent,
19 by comparing the variance obtained in said variance
20 calculating step with a predetermined value; and

21 (e) a moving-direction recognizing step of
22 recognizing a direction in which the moving object moves,
23 based on a direction of occurrence of the object-appearing
24 zone found as the result of discrimination in said zone
25 discriminating step.

1 20. A moving object detecting method according to
2 claim 19, wherein said zone discriminating step uses a
3 first discriminating way such that

4 if the variance is equal to or larger than said
5 predetermined value, the plural zones are judged as the

6 object-appearing zones, and

7 if the variance is equal to or smaller than said
8 predetermined value, the plural zones are judged as the
9 object-free zones.

1 21. A moving object detecting method according to
2 claim 19, wherein said zone discriminating step uses a
3 second discriminating way such that

4 if the amount of change in the variance is equal
5 to or larger than a predetermined value, the plural zones
6 are judged as the object-appearing zones, and

7 if the amount of change in the variance is equal
8 to or smaller than said predetermined value, the plural
9 zones are judged as the object-free zones.

1 22. A moving object detecting method according to
2 claim 21, wherein in said zone discriminating step, said
3 predetermined value is created from an average value of
4 the past variance of brightness values before the current
5 time.

1 23. A moving object detecting method according to
2 claim 20, wherein in said moving-direction recognizing
3 step, the direction of moving of the moving object is
4 recognized using one of said first and second recognizing
5 ways.

1 24. A moving object detecting method according to
2 claim 21, wherein in said moving-direction recognizing
3 step, the direction of moving of the moving object is
4 recognized using one of said first and second recognizing
5 ways.

1 25. A moving object detecting method according to
2 claim 22, wherein in said moving-direction recognizing
3 step, the direction of moving of the moving object is
4 recognized using one of said first and second recognizing
5 ways.

1 26. An apparatus for detecting a moving object in
2 an input image, comprising:

3 (a) an input image retaining section for retaining
4 the input image;

5 (b) a background image retaining section, connected
6 to said input image retaining section, for retaining a
7 given background image;

8 (c) a background difference calculating section,
9 connected to said input image retaining section and said
10 background image retaining section, for calculating a
11 difference between the input image and the background
12 image;

13 (d) a moving direction recognizing section,
14 connected to said input image retaining section, for
15 dividing data of the input image into a plurality of pieces

16 of data one piece for each of a plurality of zones and
17 evaluating the data; and

18 (e) a united judging section, connected to said
19 background difference calculating section and said moving
20 direction recognizing section, for judging the appearance
21 of the moving object and the direction of moving of the
22 moving object.

1 27. A moving object detecting apparatus according
2 to claim 26, wherein said background difference
3 calculating section includes:

4 a block-background difference calculating unit,
5 connected to said input image retaining section and the
6 background image retaining section, for comparing first
7 unit blocks related to the input image with second unit
8 blocks related to the background image to extract a moving
9 block in which a change occurs in brightness distribution
10 pattern; and

11 an in-moving-area background difference
12 calculating unit, connected to said block-background
13 difference calculating unit, for setting a moving area
14 surrounding the extracted moving block and comparing the
15 distribution pattern of brightness values of the input
16 image and the distribution pattern of brightness values
17 of the background image to discriminate whether the moving
18 object appears in the input image.

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1 28. A moving object detecting apparatus according
2 to claim 26, wherein said moving direction recognizing
3 section includes:

4 a zone information retaining unit for retaining and
5 outputting zone division information related to division
6 of the input image into the plural zones;

7 a variance calculating unit, connected to said zone
8 information retaining unit and said input image retaining
9 section, for dividing data of the input image, which is
10 retained in said input image retaining section, into the
11 plural pieces of data one piece for each the plural zones
12 in accordance with the zone division information output
13 from said zone information retaining unit, and for
14 calculating variance of brightness values for every one
15 of the plural zones;

16 a variance history managing unit for retaining and
17 outputting history information related to the past
18 variance before the current time and calculated for each
19 and every one of the plural zones; and

20 a variance evaluating unit, connected to said
21 variance calculating unit and said variance history
22 managing unit, for evaluating the variance calculated by
23 said variance calculating unit and the history
24 information output from said variance history managing
25 unit.